ZooKeys 779: 1–17 (2018)
doi: 10.3897/zookeys.779.24562
http://zookeys.pensoft.net

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First survey of Interstitial molluscs from Cayo Nuevo, Campeche Bank, Gulf of Mexico

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Academic editor: *N. Yonow* | Received 20 February 2018 | Accepted 9 July 2018 | Published 2 August 2018

http://zoobank.org/CE8D6959-7966-480C-ADF6-D514071AAF29

Citation: Ortigosa D, Suárez-Mozo NY, Barrera NC, Simões N (2018) First survey of Interstitial molluscs from Cayo Nuevo, Campeche Bank, Gulf of Mexico. ZooKeys 779: 1–17. https://doi.org/10.3897/zookeys.779.24562

Abstract

Six sediment samples weighing between 224–735 g were collected in June of 2016 from Cayo Nuevo reef, located at the Campeche Bank, southern Gulf of Mexico. Samples were collected by SCUBA diving, from were two stations at depths of 7.6 and 18.2 m. Sediment was sieved and molluscs (adults and micromolluscs ≤ 10 mm) were sorted, examined, and identified to the lowest taxonomic level. A total of 1,347 specimens was found, of which 224 shells were dead and 1,123 were alive. Thirty-four families, 53 genera, and 67 species were identified. The most abundant families were Chamidae and Arcidae for the Bivalvia class, and Caecidae and Tornidae for the Gastropoda class. The vertical range of *Bentharca* sp. was extended.

Keywords

baseline, inventory, Campeche Bank, Gulf of Mexico, micromolluscs

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Introduction

Frequently, species molluscan biodiversity accounts are incomplete because of the lack of some groups such as sea slugs and micromolluscs. Compared with macromolluscs, the study of micromolluscs is still in its infancy, which is probably due not to the difficulty involved in obtaining samples, but difficulties in identification of such small animals and the time-consuming process required to separate specimens from sand or other substrates (e.g., algae or rocks), and photography. In order to get a more realistic picture of the biodiversity for different habitats, micromolluscs should be incorporated into the different studies (Sasaki 2008, and pers. obs.).

The term micromollusc has been applied in arbitrary and non-standardised ways. Micromolluscs are molluscs not visible without some type of artificial assistance, such as a microscope or magnifying glass. The most restrictive definition, or *sensu stricto,* stated that micromollusc size should be less than 5 mm as an adult (Narciso 2005, Geiger et al. 2007). Other authors considered micromolluscs as specimens smaller than 10 mm as an adult (Barrera and Tunnell 2001). Finally, the wider definition of micromollusc, or *sensu lato*, includes molluscs whose size is typically less than 10 mm as an adult and also included juvenile representative of macromolluscs (Moore 1964; García-Cubas 1970; Tunnell 1974; Kay 1980; Vokes and Vokes 1983).

Barrera (2001) stated that within Texas and Mexico, the majority of the studies involved macromolluscs. In Mexico, more than 4,643 species of marine molluscs have been recorded, and approximately 2,067 of them inhabit the Gulf of Mexico (GoMx) and the Mexican Caribbean Sea (Castillo-Rodríguez 2014). Unfortunately, Castillo-Rodríguez did not state which of them were micromolluscs. Important molluscan compilations focusing on these groups include publications by García-Cubas and Reguero (2007) and Vokes and Vokes (1983), although only a few publications have addressed the micromolluscan fauna specifically such as García-Cubas (1963, 1970 and 1971) for lagoons in the Gulf of Mexico and Hicks et al. (2001) at Alacranes reef.

The Campeche Bank is located at the southern GoMx and is composed of several emergent and submerged coral reefs (Tunnell et al. 2010). One of the smaller and most remote reefs is Cayo Nuevo, located between Arenas and Triángulos reefs (190 km offshore) in the GoMx (Fig. 1). Studies on this reef are almost non-existent with the exception of polychaetes (Granados-Barba et al. 2003).

The present work focuses on the molluscs of the Cayo Nuevo sandy bottoms, Gulf of Mexico. In this substrate we could find micromolluscs *sensu stricto* and juveniles of macromolluscs species that inhabit the interstitial as but also empty shells that could be carried by external factors such wind and currents.

Materials and methods

Using SCUBA gear, six sediment samples of coarse sand to fine gravel weighing 224–735 g each were collected by hand at 7.6 and 18.2 m on 19 June 2017 at Cayo Nuevo

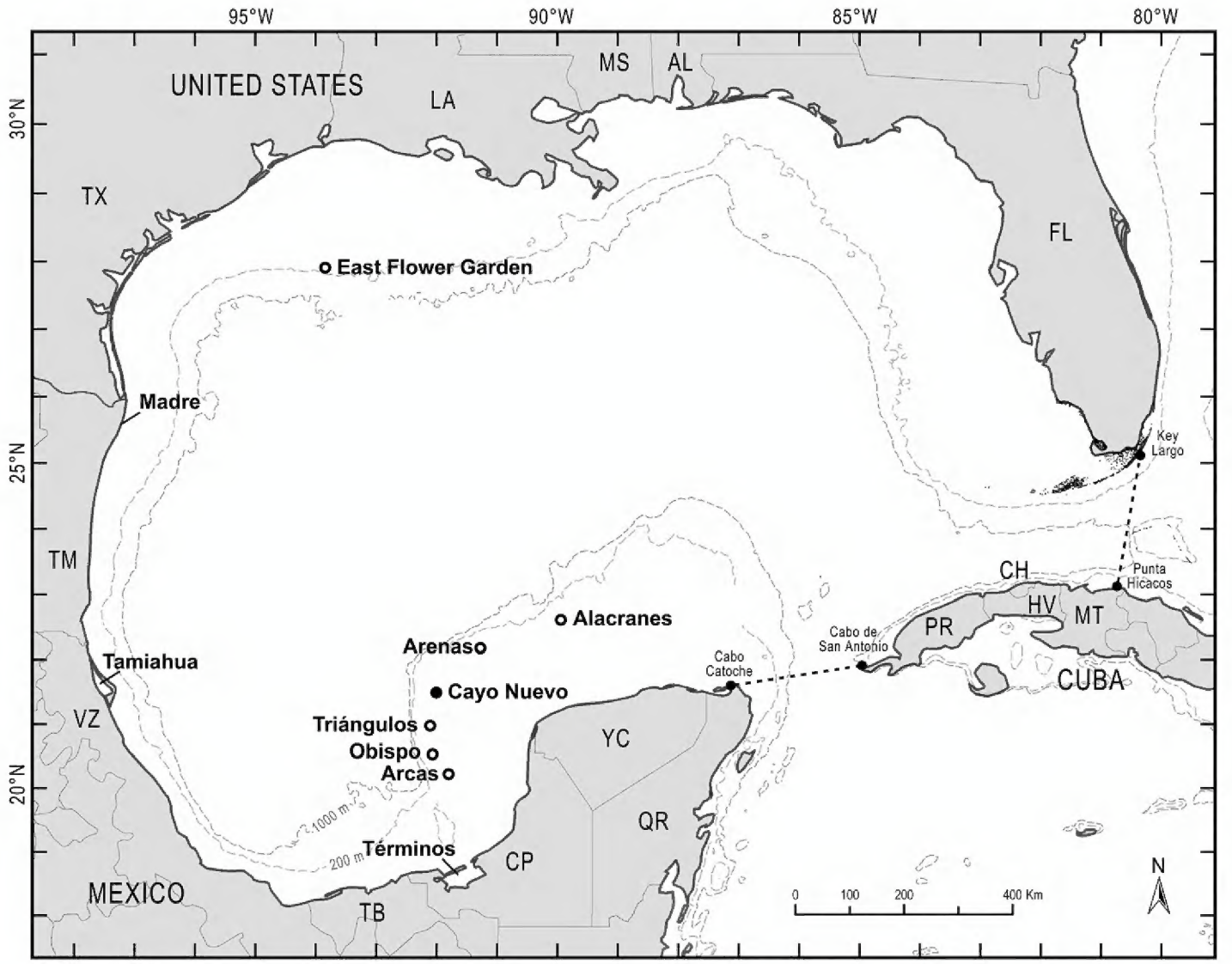

Figure 1. Map of the Gulf of Mexico, with the largest reef in the GoMx and sampling locations where micromolluscs have been documented in the literature and this study (adapted from Felder and Camp 2009).

Table 1. Sampling stations and coordinates at Cayo Nuevo on 18 June 2016.

Station	Depth (m)	Latitude (N)	Longitude (W)	Sample
1	18.2	21°49'40.32"	92°4'37.62"	GoMex-001
				GoMex-002
				GoMex-002
				GoMex-004
2	7.6	21°49'47.82"	92°4'34.32"	GoMex-005
				GoMex-006

reef (Table 1). Each sample was sieved by pouring water through six differently sized sieves (2 mm, 1.4 mm, 1 mm; 710 µm, 500 µm, and 250 µm) (Table 2) and sorted dry using a dissecting Nikon SMZ800 microscope. Specimens were picked out using soft forceps and 000 fine paint brushes. Molluscs were placed into 2 mm tubes and micromolluscs were placed into PCR tubes, both with 70% ethanol for long-term storage. Identification of specimens to species level was based on Abbott (1974), Tunnell et al. (2010) and Redfern (2013). Whenever possible, at least one specimen of each species

Table 2. Weight of each sample per sieve size in grams.

Sieve	GoMex-001	GoMex-002	GoMex-002	GoMex-004	GoMex-005	GoMex-006
2 mm	86.89	335.85	372.2	645.4	679.1	615.19
1.4 mm	46.94	60.04	21.7	46	80.7	91.53
1 mm	34.01	28.43	5.7	27.3	14.8	22.96
710 µm	27.1	11.13	1.3	28.5	2.3	5.32
500 µm	16.04	3.07	0.3	16.7	0.7	0.82
250 µm	13.86	1.2	0.07	2.6	0.6	0.004
Total	224.84	439.72	401.27	766.5	778.2	735.824

or morphotype was photographed. All the specimens were deposited at the "Colección de Moluscos de la Peninsula de Yucatán" (**CMPY**), Unidad Multidisciplinaria de Docencia e Investigación Campus Sisal, Universidad Nacional Autónoma de México.

The nomenclature of the species listed was assigned according to Bouchet and Rocroi (2010) for Bivalvia, Bouchet et al. (2017) for Gastropoda, and Kaas and Van Belle (1985) for Polyplacophora, due to the variability of some categories we only present the Linnaean ones. Abundance categories were assigned following Hicks et al. (2001): Abundant ≥ 50 (A); Common = 6–49 (C); Uncommon = 2–5 (UC), and Rare = 1 (R). Juvenile species are denoted by an asterisk (*).

Results

The results from the analysis of the sediment from Cayo Nuevo reef revealed 67 species of molluscs, from which 50 species are gastropods, 14 species are bivalves and three are chitons. These species belong to 38 different families.

Phylum Mollusca Linnaeus, 1758
Class Polyplacophora Gray, 1821
Polyplacophora sp. 1 * (R) (Fig. 2-1)
Polyplacophora sp. 2 * (R) (Fig. 2-2)

Order Chitonina Thiele, 1909
Family Chitonoidea Rafinesque, 1815
Genus *Ischnochiton* Gray, 1847
***Ischnochiton* sp.** * (UC) (Fig. 2-3)

Class Bivalvia Linnaeus, 1758
Order Arcida Stoliczka, 1871
Family Arcidae Lamarck, 1809
Arcidae sp. (UC) (Fig. 2-4)
Genus *Arca* Linnaeus, 1758
***Arca imbricata* Bruguière, 1789** * (UC) (Fig. 2-5a, b)

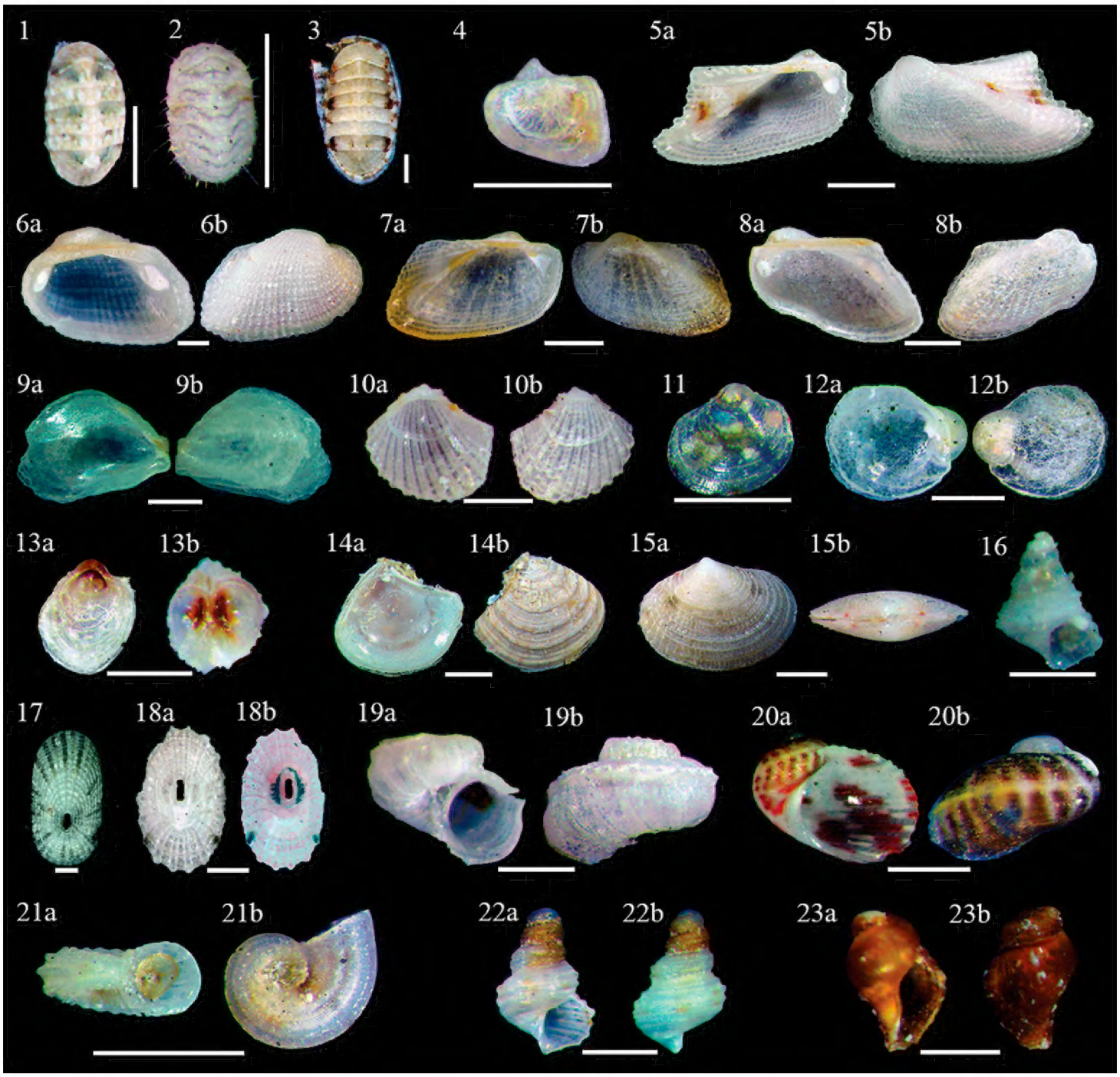

Figure 2. Polyplacophora **1–3**: **1** Polyplacophora sp. 1, dorsal view, scale bar 0.5 mm **2** Polyplacophora sp. 2, dorsal view, scale bar 1 mm **3** *Ischnochiton* sp., dorsal view, scale bar 0.5 mm. Bivalvia **4–15**: **4** Arcidae sp., dorsal view, scale bar 0.5 mm **5** *Arca imbricata* **5a** ventral view **5b** dorsal view, scale bar 1 mm **6** *Barbatia domingensis* **6a** ventral view **6b** dorsal view, scale bar 1 mm **7** *Barbatia* sp. **7a** ventral view **7b** dorsal view, scale bar 1 mm **8** *Bentharca* sp. **8a** ventral view **8b** dorsal view, scale bar 1 mm **9** *Anomia* sp. **9a** ventral view **9b** dorsal view, scale bar 1 mm **10** *Carditopsis smithii* **10a** ventral view **10b** dorsal view, scale bar 1 mm, **11** Lucinidae sp., ventral view, scale bar 0.5 mm **12** *Chama sinuosa* **12a** ventral view **12b** dorsal view, scale bar 0.5 mm **13** Chamidae sp. **13a** ventral view **13b** dorsal view, scale bar 1 mm, **14** *Crassinella lunulata* **14a** ventral view **14b** dorsal view, scale bar 1 mm **15** *Semele bellastriata* **15a** dorsal view **15b** lateral view, scale bar 1 mm. Gastropoda **16–23**: **16** Gastropoda sp., ventral view, scale bar 0.5 mm, **17** *Diodora minuta*, ventral view, scale bar 0.25, **18** *Diodora listeri* **18a** ventral view **18b** dorsal view, scale bar 1 mm, **19** *Scissurella redferni* **19a** ventral view **19b** dorsal view, scale bar 1 mm **20** *Synaptocohlea picta* **20a** ventral view **20b** dorsal view, scale bar 1 mm **21** *Lodderena ornata* **21a** ventral view **21b** Apical view, scale bar 0.5 mm **22** *Cerithium* sp. 1 **22a** ventral view **22b** dorsal view, 1 scale bar 1 mm **23** *Cerithium* sp. 2 **23a** ventral view **23b** dorsal view, scale bar 1 mm.

Genus *Barbatia* Gray, 1842
Barbatia domingensis * (Lamarck, 1819) (UC) (Fig. 2-6a, b)
***Barbatia* sp.** * (C) (Fig. 2-7a, b)

Genus *Bentharca* Verrill & Bush, 1898
***Bentharca* sp.** (R) (Fig. 2-8a, b)

Order Mytilida Férussac, 1822
Family Mytilidae Rafinesque, 1815
Genus *Crenella* T. Brown, 1827
***Crenella* sp.** (R)

Order Pectinida Gray, 1854
Family Anomiidae Rafinesque, 1815
Genus *Anomia* Linnaeus, 1758
Anomia* sp. (R) (Fig. 2-9a, b)

Order Cardita Bruguière, 1792
Family Carditidae Férussac, 1822
Genus *Carditopsis* E. A. Smith, 1881
***Carditopsis smithii* (Dall, 1896)** (C) (Fig. 2-10a, b)

Order Lucinida Gray, 1854
Family Lucinidae J. Fleming, 1828
Lucinidae sp. * (UC) (Fig. 2-11)

Order Venerida Gray, 1854
Family Chamidae Lamarck, 1809
Chamidae sp. (UC) (Fig. 2-12a, b)
Genus *Chama* Linnaeus, 1758
***Chama sinuosa* Broderip, 1835** * (A) (Fig. 2-13a, b)

Family Galeommatidae Gray, 1840
Galeommatidae sp. (R)

Order Carditida Dall, 1889
Family Crassatellidae Férussac, 1822
Genus *Crassinella* Guppy, 1874
Crassinella lunulata (Conrad, 1834) * (R) (Fig. 2-14a, b)

Order Cardiida Férussac, 1822
Family Semelidae Stoliczka, 1870 (1825)
Genus *Semele* Schumacher, 1817
***Semele bellastriata* (Conrad, 1837)** * (UC) (Fig. 2-15a, b)

Class Gastropoda Cuvier, 1795
Gastropoda sp. * (R) (Fig. 2-16)

Order Lepetelloidea Dall, 1882
Family Fissurellidae Fleming, 1822
Genus *Diodora* Gray, 1821
***Diodora minuta* (Lamarck, 1822)** * (UC) (Fig. 2-17)
***Diodora listeri* (d'Orbigny, 1847)** (R) (Fig. 2-18a, b)

Family Scissurellidae Gray, 1847
Genus *Scissurella* d'Orbigny, 1824
***Scissurella redferni* (Rolán, 1996)** (C) (Fig. 2-19a, b)

Order Trochida Rafinesque, 1815
Family Trochidae Rafinesque, 1815
Genus *Synaptocochlea* Pilsbry, 1890
***Synaptocochlea picta* (d'Orbigny, 1847)** (A) (Fig. 2-20a, b)

Family Skeneidae W. Clark, 1851
Genus Lodderena Iredale, 1924
***Lodderena ornata* (Olsson & McGinty, 1958)** (A) (Fig. 2-21a, b)

Family Cerithiidae Fleming, 1822
Genus *Cerithium* Bruguière, 1789
***Cerithium* sp. 1** (R) (Fig. 2-22a, 22b)
***Cerithium* sp. 2** (UC) (Fig. 2-23a, 23b)
***Cerithium atratum* (Borns, 1778)** (R) (Fig. 3-1a, b)

Family Litiopidae Gray, 1847
Genus *Alaba* H. adams & A. Adams, 1853
***Alaba incerta* (d'Orbigny, 1841)** (C) (Fig. 3-2a, b)

Family Scaliolidae Jousseaume, 1912
***Finella* sp.** (UC) (Fig. 3-3a, 3b)

Family Pickworthiidae Iredale, 1917
Subfamily Pickworthiinae Iredale, 1917
Genus *Sansonia* Jousseaume, 1892
***Sansonia tuberculata* (Watson, 1886)** (R) (Fig. 3-4a, b)

Family Hypponicidae Troschel, 1861
***Hipponix* sp.** (C) (Fig. 3-5a, 5b)

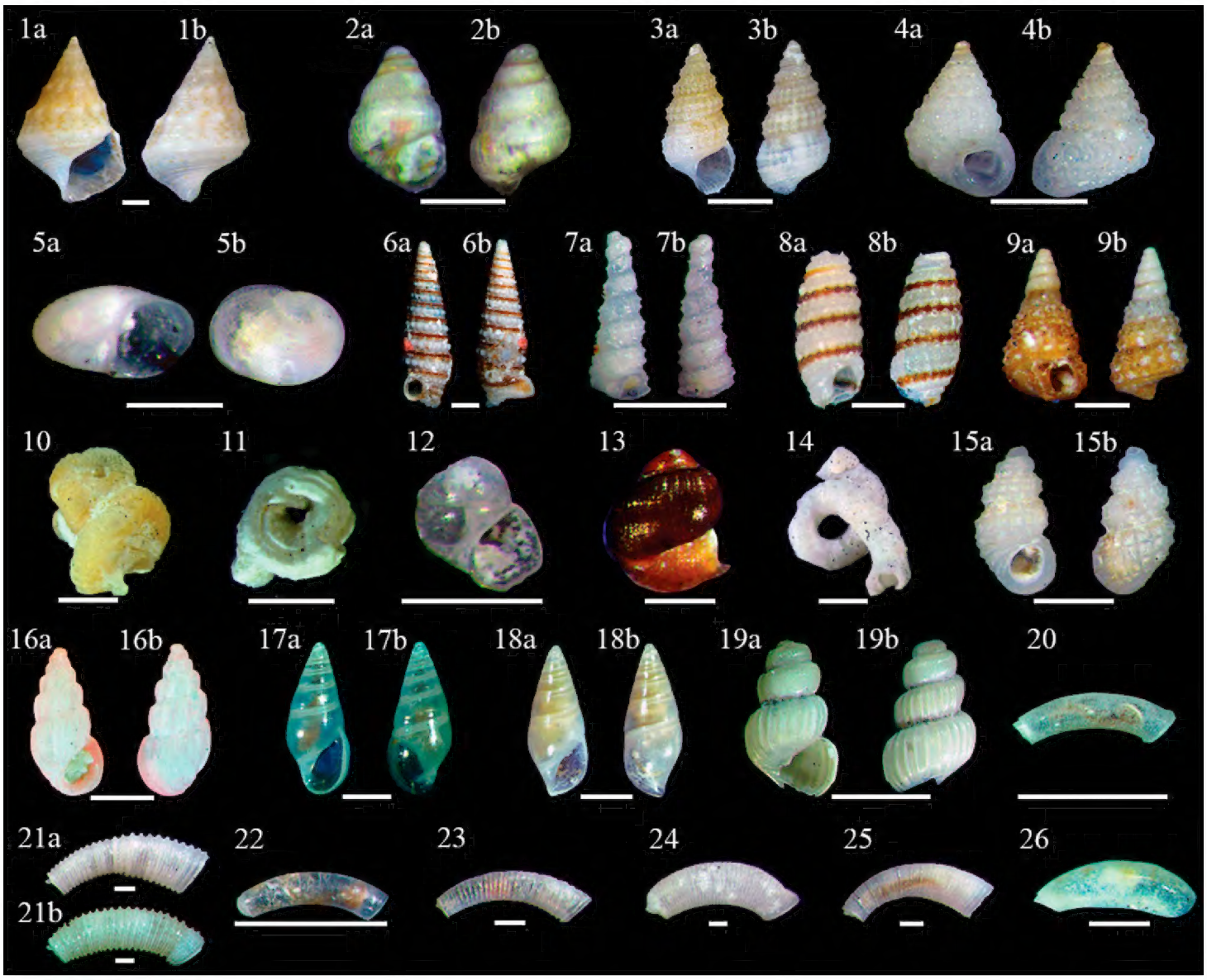

Figure 3. Gastropoda **1–26**: **1** *Cerithium atratum* **1a** ventral view **1b** dorsal view, scale bar 1 mm **2** *Alaba incerta* **2a** ventral view **2b** dorsal view, scale bar 0.25 mm **3** *Finella* sp. **3a** ventral view **3b** dorsal view, scale bar 1 mm **4** *Sansonia tuberculata* **4a** ventral view **4b** dorsal view, scale bar 1 mm **5** *Hipponix* sp. **5a** ventral view **5b** dorsal view, scale bar 0.1 mm **6** *Iniforis turristhomae* **6a** ventral view **6b** dorsal view, scale bar 1 mm **7** *Metaxia rugulosa* **7a** ventral view **7b** dorsal view, scale bar 0.5 mm **8** *Cerithiopsis* sp. **8a** ventral view **8b** dorsal view, scale bar 1 mm **9** *Cerithiopsis* cf. *iuxtafuniculata* **9a** ventral view **9b** dorsal view, scale bar 1 mm **10** Vermetidae *incertae sedis* irregularis scale bar 1 mm **11** *Dendropoma corrodens* scale bar 1 mm **12** Vermetid sp. C, ventral view, scale bar 0.25 mm **13** *Petaloconchus mcgintyi*, ventral view, scale bar 0.25 mm **14** *Thylacodes* sp. scale bar 1 mm **15** *Simulamerelina caribaea* **15a** ventral view **15b** dorsal view, scale bar 1 mm **16** *Schwartziella fischeri* **16a** ventral view **16b** dorsal view, scale bar 1 mm **17** *Zebina* sp. 2 **17a** ventral view **17b** dorsal view, scale bar 1 mm **18** *Zebina* sp. 2 **18a** ventral view **18b** dorsal view, scale bar 0.5 mm **19** *Truncatella* sp. **19a** ventral view **19b** dorsal view, scale bar 0.5 mm **20** *Caecum circumvolutum*, lateral view, scale bar 0.2 mm **21** *Caecum donmoorei* **21a** stage 1, lateral view, scale bar 0.2 mm **21b** adult, lateral view, scale bar 0.2 mm **22** *Caecum johnsoni*, lateral view, scale bar 0.2 mm **23** *Caecum pulchellum*, lateral view, scale bar 0.2 mm **24** *Caecum textile*, lateral view, scale bar 0.2 mm **25** *Caecum* sp. B, lateral view, scale bar 0.2 mm **26** *Meioceras nitidum*, lateral view, scale bar 0.2 mm.

Family Triphoridae Gray, 1847
Genus *Iniforis* Jousseaume, 1884
***Iniforis turristhomae* (Holten, 1802)** (UC) (Fig. 3-6a, b)

Genus *Metaxia* Monterosato, 1884
***Metaxia rugulosa* (C. B. Adams, 1850)** (R) (Fig. 3-7a, b)

Family Cerithiopsidae H. Adams & A. Adams, 1853
Genus *Cerithiopsis* Forbes & Hanley, 1850
***Cerithiopsis* sp.** (R) (Fig. 3-8a, 8b)
***Cerithiopsis* cf. *iuxtafuniculata* Rolán, Espinosa & Fernández-Garcés, 2007** (R) (Fig. 3-9a, b)

Family Vermetidae Rafinesque, 1815
Vermetidae *incertae sedis irregularis* d'Orbigny, 1841 (Fig. 3-10)

Genus *Dendropoma* Mörch, 1861
***Dendropoma corrodens* (d'Orbigny, 1841)** (R) (Fig. 3-11)
Vermetid sp. C Redfern 2013 (A) (Fig. 3-12)

Genus *Petaloconchus* Lea, 1843
***Petaloconchus mcgintyi* (Olsson & Harbison, 1953)** * (C) (Fig. 3-13)

Genus *Thylacodes* Guettard, 1770
***Thylacodes* sp.** * (R) (Fig. 3-14)

Family Rissoidae Gray, 1847
Genus *Simulamerelina* Ponder, 1985
***Simulamerelina caribaea* (d'Orbigny, 1842)** (UC) (Fig. 3-15a, b)

Family Zebinidae Coan, 1964
Genus *Schwartziella* G. Nevill, 1881
***Schwartziella fischeri* (Desjardin, 1949)** (UC) (Fig. 3-16a, b)

Genus *Zebina* H. Adams & A. Adams, 1854
***Zebina* sp. 1** (A) (Fig. 3-17a, 17b)
***Zebina* sp. 2** (C) (Fig. 3-18a, 18b)

Family Truncatellidae Gray, 1840
Genus Truncatella Risso, 1826
***Truncatella* sp.** (R) (Fig. 4-19a, 19b)

Family Caecidae Gray, 1850
Genus *Caecum* Fleming, 1813
***Caecum circumvolutum* de Folin, 1867** (C) (Fig. 3-20)
***Caecum donmoorei* Mitchell-Tapping, 1979** (C) (Fig. 3-21a, b)
***Caecum johnsoni* Winkley, 1908** (A) (Fig. 3-22)

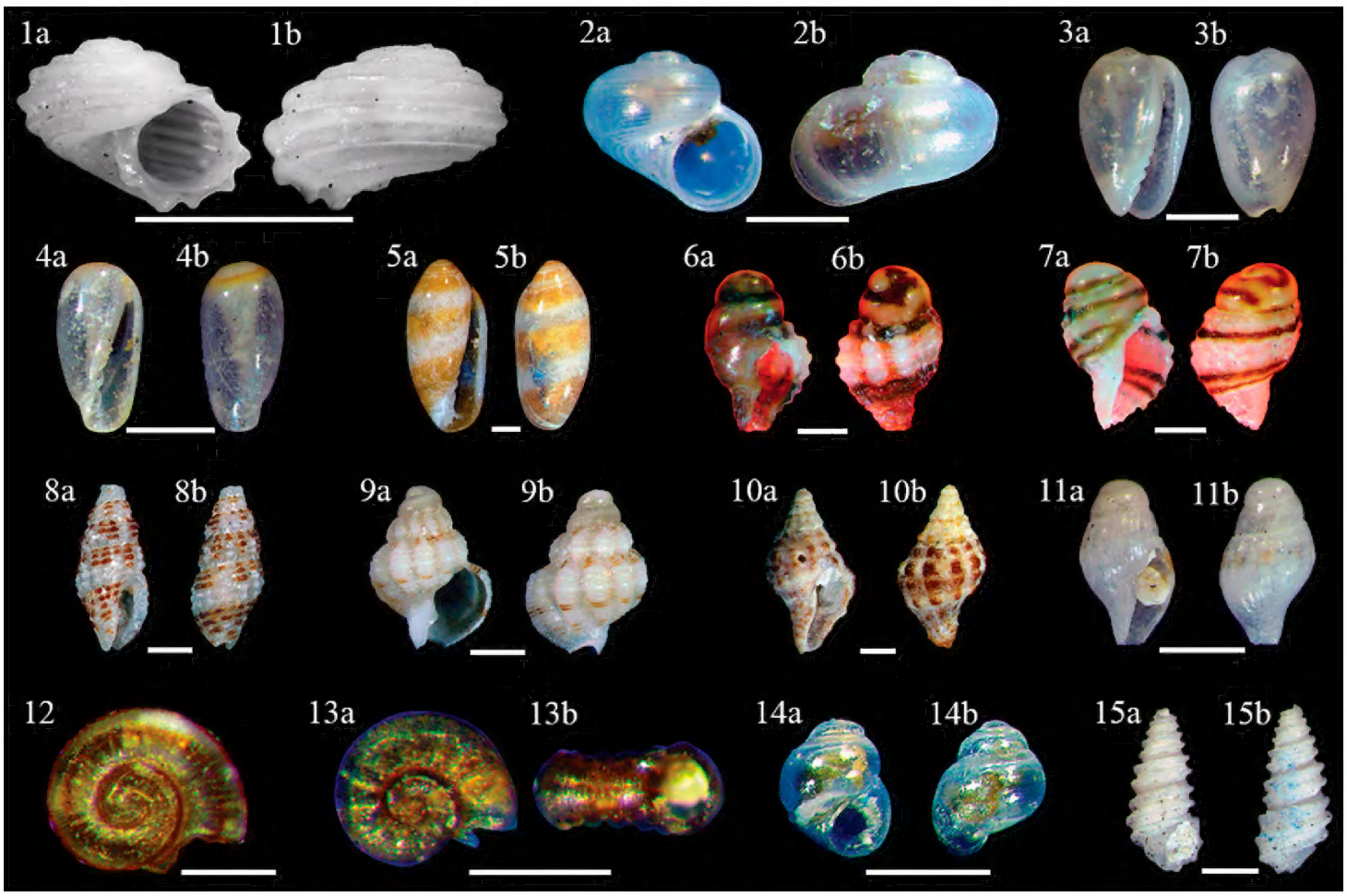

Figure 4. Gastropoda **1–18: 1** *Parviturboides* sp. **1a** ventral view **1b** dorsal view, scale bar 1 mm **2** *Vitrinella* sp. **2a** ventral view **2b** dorsal view, scale bar 0.5 mm **3** *Gibberula lavalleeana* **3a** ventral view **3b** dorsal view, scale bar 1 mm **4** *Volvarina* sp. 1 **4a** ventral view **4b** dorsal view, scale bar 1 mm **5** *Volvarina* sp. 2 **5a** ventral view **5b** dorsal view, scale bar 1 mm **6** Columbellidae sp. 1 **6a** ventral view **6b** dorsal view, scale bar 0.5 mm **7** Columbellidae sp. 2 **7a** ventral view **7b** dorsal view, scale bar 0.5 mm **8** *Steironepion moniferum* **8a** ventral view **8b** dorsal view, scale bar 1 mm **9** *Phrontis* sp. 9a ventral view **9b** dorsal view, scale bar 0.5 mm **10** *Trachypollia* sp. **10a** ventral view **10b** dorsal view, scale bar 1 mm **11** Turridae sp. 1 **11a** ventral view **11b** dorsal view, scale bar 1 mm **12** *Ammonicera lineofuscata*, Apical view, scale bar 0.25 mm **13** *Ammonicera minortalis* **13a** Apical view **13b** ventral view, scale bar 0.1 mm **14** *Rissoella galba* **14a** ventral view **14b** dorsal view, scale bar 0.1 mm **15** *Pseudoscilla* aff. *babylonia* **15a** ventral view **15b** dorsal view, scale bar 1 mm.

***Caecum pulchellum* Stimpson, 1851** (C) (Fig. 3-23)
***Caecum textile* de Folin, 1867** (UC) (Fig. 3-24)
***Caecum* sp. B *sensu* Redfern 2013** (C) (Fig. 3-25)

Genus *Meioceras* Carpenter, 1859
***Meioceras nitidum* (Stimpson, 1851)** (UC) (Fig. 3-26)

Family Tornidae Sacco, 1896 (1884)
Genus *Parviturboides* Pilsbry & McGinty, 1949
***Parviturboides* sp.** (C) (Fig. 4-1a, b)

Genus *Vitrinella* C. B. Adams, 1850
***Vitrinella* sp.** (A) (Fig. 4-2a, b)

Family Cystiscidae Stimpson, 1865
Genus *Gibberula* Swainson, 1840
***Gibberula lavalleeana* (d'Orbigny, 1824)** (UC) (Fig. 4-3a, b)

Family Marginellidae Fleming, 1828
Genus *Volvarina* Hinds, 1844
***Volvarina* sp. 1** (UC) (Fig. 4-4a, 4b)
***Volvarina* sp. 2** (R) (Fig. 4-5a, 5b)

Family Columbellidae Swainson, 1840
Columbellidae sp. 1 (UC) (Fig. 4-6a, b)
Columbellidae sp. 2 (R) (Fig. 4-7a, 7b)
Genus *Steironepion* Pilsbry & H. N. Lowe, 1932
***Steironepion moniliferum* (G. B. Sowerby I, 1844)** (UC) (Fig. 4-8a, b)

Family Nassariidae Iredale, 1916 (1835)
Genus *Phrontis* H. Adams & A. Adams, 1853
***Phrontis* sp.** (UC) (Fig. 4-9a, b)

Family Muricidae Rafinesque, 1815
Genus *Trachypollia* Woodring, 1928
***Trachypollia* sp.** (R) (Fig. 4-10a, b)

Family "Turridae" H. Adams & A. Adams, 1853 (1838)
Turridae sp. 1 (R) (Fig. 4-11a, 11b)

Family Omalogyridae G.O. Sars, 1878
Genus *Ammonicera* Vayssière, 1893
***Ammonicera lineofuscata* Rolán, 1992** (A) (Fig. 4-12)
***Ammonicera minortalis* Rolán, 1992** (A) (Fig. 4-13a, b)

Family Rissoellidae Gray, 1850
Genus Rissoella Gray, 1847
***Rissoella galba* Robertson, 1961** (R) (Fig. 4-14a, b)

Order Aplysiida
Family Aplysiidae Lamarck, 1809
Genus *Aplysia* Linnaeus, 1767
***Aplysia* sp.** (R)

Order Siphonarimorpha
Family Pyramidellidae Gray, 1840
Genus *Pseudoscilla* Boettger, 1901
***Pseudoscilla* aff. *babylonia* (C. B. Adams, 1845)** (R) (Fig. 4-15a, 185b)

Discussion

The most abundant families of gastropods were the Caecidae (456 specimens, seven species), Tornidae (221 specimens, two species), and Omalogyridae (132 specimens, two species). The most abundant families of bivalves were Arcidae (40 specimens, five species) and Chamidae (59 specimens, two species). The most abundant gastropod species were *Caecum johnsoni* (310 specimens), *Vitrinella* sp. (208 specimens), Vermetid sp. C (91 specimens), *Lodderena ornata* (71 specimens), and *Caecum donmoorei* (147 specimens). For the Bivalvia the most abundant species were *Chama sinuosa* (57 specimens), *Barbatia domingensis* (57 specimens) and *Carditopsis smithii* (12 specimens).

From the six sediment samples, the most commonly found molluscs were *Lodderena ornata*, *Caecum johnsoni* and *Ammonicera lineofuscata*, while other species appeared only once: *Leptochiton* sp., Arcidae sp., *Bentharca* sp., *Crenella* sp., *Anomia* sp., *Chama* sp., Galeommatidae sp., *Chione elevata*, *Semele bellastriata*, *Cerithium* sp. 1, Gastropoda sp., *Diodora listeri*, *Cerithium atratum*, *Sansonia tuberculata*, *Iniforis turristhomae*, *Metaxia rugulosa*, *Cerithiopsis* cf. *iuxtafuniculata*, *Cerithiopsis* sp., Vermetidae *incertae sedis* irregularis, *Dendropoma corrondens*, *Thylacodes* sp., *Finella* sp., *Caecum textile*, *Hipponix* sp., *Volvarina* sp. 2, Columbellidae sp. 2, *Aplysia* sp., and *Pseudoscilla* aff. *babylonia*.

This new data becomes a taxonomic reference list for the molluscs that inhabit Cayo Nuevo, GoMx, including micromolluscs as well as juvenile macromolluscs. To place it within a useful context we mention other inventories made in this area: Felder and Camp (2009) recorded some 5,517 species of invertebrates in the GoMx, of which 2,455 were marine molluscs (Moretzsohn et al. 2009). González et al. (1991) recorded 298 species of molluscs and included 33 localities distributed around the coasts of the Yucatan Peninsula and adjacent coral reefs but did not mentioned Cayo Nuevo. García-Cubas et al. (1999) recorded 110 species of gastropods in the northern and northeastern regions of the Yucatan Peninsula. Rice and Kornicker (1962) recorded 130 species for Alacranes reef in the Campeche Bank and later, Hicks et al. (2001) recorded 215 species of molluscs on the same reef. Although earlier articles include reefs or sampling locations within the Bank of Campeche (e.g., Rehder and Abbott 1951, Springer and Bullis 1956, Kornicker et al. 1959), no mention of molluscs from Cayo Nuevo were found. Only Barrera (2001) study focuses on reef micromolluscs, recording 131 species from the East and West Flower Garden Banks (FGB).

The molluscan assemblage at Cayo Nuevo shares many species also present at the FGB (Barrera 2001) and Alacranes Reef (Hicks et al. 2001) (19 families/21 genera and 21 families/22 genera, respectively) (Table 3). The most diverse families recorded by Barrera (2001) and Hicks et al. (2001) were Caecidae (six genera and ten species) and Rissoidae (five genera and seven species) for Gastropoda and Arcidae (four genera and seven species) for Bivalvia.

Barrera (2001) most abundant gastropod species were *Amphithalamus vallei* (672 individuals) and cf. *Vitrinella* sp. (534 individuals); however, at Cayo Nuevo, 208 individuals of sf. *Vitrinella* sp., were found. Differences in the numbers of collected individ-

Table 3. Comparison of molluscs recorded at Cayo Nuevo (present study) and other interstial records at the GoMx; Madre: García-Cubas (1970), Tamiahua: García-Cubas (1971), Términos: García-Cubas (1963, 1981), East Flower Garden: Barrera and Tunnell (2001), Alacranes: Hicks et al. (2001). The maximum recorded size is provided: Key: a) García-Cubas and Reguero (2004), b) Tunnell et al. (2010), c) Redfern (2013).

Systematics	Lagoons			Reefs			Maximum recorded size (mm)
	Madre	Tamiahua	Términos	East Flower Garden	Alacranes	Cayo Nuevo	
Class Bivalvia							
Arca imbricata			*		*	*	48[c]
Barbatia domingensis				*	*	*	30[b]
Carditopsis smithii				*	*	*	1.5[c]
Chama sinuosa					*	*	76[b]
Crassinella lunulata		*				*	8[b]
Semele bellastriata						*	14[c]
Class Gastropoda							
Diodora minuta						*	10.5[c]
Diodora listeri					*	*	45[b]
Scissurella redferni						*	1[c]
Synaptocochlea picta					*	*	3.5[c]
Lodderena ornata				*	*	*	0.8[c]
Cerithium atratum						*	
Alaba incerta						*	
Sansonia tuberculata						*	1.5[c]
Iniforis turristhomae				*	*	*	6[c]
Metaxia rugulosa						*	7[c]
Cerithiopsis cf. *iuxtafuniculata*						*	3[c]
Vermetidae *incertae sedis irregularis*						*	6[b]
Dendropoma corrodens					*	*	10[b]
Petaloconchus mcgintyi				*	*	*	35[b]
Simulamerelina caribaea						*	3[b]
Schwartziella fischeri						*	3.5[c]
Caecum circumvolutum						*	4[b]
Caecum donmoorei						*	2[c]
Caecum johnsoni			*	*		*	5[b]
Caecum pulchellum	*	*	*	*	*	*	2[a]
Caecum textile					*	*	2[b]
Meioceras nitidum		*	*			*	3[b]
Gibberula lavalleeana		*				*	4[b]
Steironepion moniliferum						*	
Ammonicera lineofuscata						*	0.6[c]
Ammonicera minortalis				*		*	0.5[c]
Rissoella galba				*		*	1[c]
Pseudoscilla aff. *babylonia*				*	*	*	3[b]

uals can be explained by geography, but also by differences in the quantity of sediment collected and processed, fifteen sites with 300 ml sediment sampled at FGB and six samples of 224–735 g at Cayo Nuevo. *Vitrinella* sp. could not be identified to specific

level due to the low similarity of characters shown with other described western Atlantic species. Barrera (2001) previously suggested that it could be an undescribed new species, but further detailed studies are required to establish its identity.

Regarding bivalves, the most abundant species reported by Barrera (2001) for the FGB were *Gregariella coralliophaga* (145 individuals) (summing nine identified as *Barbatia domingensis* (102 individuals) and eleven identified as *Barbatia cancellaria* (68 individuals, currently a synonym), and *Carditopsis smithii* (51 individuals). In comparison, 37 individuals of *Barbatia domingensis* and 12 *Carditopsis smithii* were collected at Cayo Nuevo and these were not the most abundant species.

It should come as no surprise that many organisms were not identified to species level (e.g., *Leptochiton* sp., *Bentharca* sp., *Crenella* sp., *Anomia* sp., *Lottia* sp., *Diodora* sp., *Cerithium* sp., *Cerithiopsis* sp., *Thylacodes* sp., *Zebina* sp. 1, *Zebina* sp. 2, and *Phrontis* sp.). We relied on regional and local literature that in fact was scarce. In the case of juveniles, shells within a genus are similar because they share many characters and the differential characters are difficult to discern even as adults and almost impossible in juveniles. Our specimens identified under the name of *Gibberula lavalleeana* could be considerate as a species complex, due to the evidence and description of new species in Cuban waters (Espinosa and Ortea 2007).

These faunistic results from Cayo Nuevo represent the first inventory of molluscs from this remote reef. These findings contribute to record expansions for the southern GoMx of *Bentharca* sp. This contribution highlights the importance of conserving small areas that can harbour a considerable diversity of organisms. Seasonal changes on the mollusc community assemblages were not evaluated but would be an interesting future project, as would collecting growth series of species to assist in confirming identifications. In 2004, González and Torruco stated the importance of the Campeche Bank's reefs and proposed a marine reserve for the reefs located within this area, Cayo Nuevo included. However, this proposal never materialized and, up to now, only Alacranes reef has governmental protection under the status of marine reserve. Species checklists of micromolluscs, as well as other faunal groups, are of vital importance to serve as a baseline data set, due to the proximity to Mexico's offshore oil production area within the GoMx. The soft benthic interstitial mollusc communities are diverse, and their monitoring could well represent ecological indicators of ecosystem health, especially in the light of potential future oil-spills.

Acknowledgements

We give our gratitude to the researchers from the Yucatan Marine Biodiversity Team (BDMY) who participated in the expedition on the boat "Isla Mujeres", especially to P. Tapia Díaz who collected the samples. Thanks to M. Badillo Alemán and C. Galindo de Santiago for their general laboratory technical assistance and to B. Rodrigo Cobarrubias Contreras for his technical assistance with the granulometry analysis, all at the Unidad Académica Sisal, UNAM. Professor Fabio Moretzsohn kindly provided the

base map. Financial support provided by the Harte Charitable Foundation, through the Harte Research Institute (Biodiversity of the southern Gulf of Mexico) and by the CONABIO NE018 Project (Update on the knowledge of the biodiversity of shallow water benthic marine invertebrate species (<50m) from the southern GoMx). First author received a postdoctoral grant from DGAPA-UNAM 2018-2019. We are grateful to Editor Nathalie Yonow for comments in the manuscript. We also thank the reviewer Dr. Henk Dekker and two other anonymous reviewers for their constructive comments and suggestions. We dedicate this work to our malacologist colleague, Dr. Wes Tunnell, who just left us. Dr. Tunnell was always curious for the Gulf of Mexico invertebrates and tireless promoter of marine biodiversity knowledge in the region.

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Supplementary material 1

Species abundance per sample

Authors: Deneb Ortigosa, Nancy Yolimar Suárez-Mozo, Noe C. Barrera, Nuno Simões

Data type: occurences

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Link: https://doi.org/10.3897/zookeys.779.24562.suppl1